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ABSTRACT

This booklet, one of a series of background papers for the White House Conference, explores the potential of new technologies to improve library services while reducing library costs. Separate subsections describe the application of technology to the following library functions: acquisitions, catalogs and cataloging, serials control, circulation control, information retrieval services, interlibrary loan, security, and management and adminstration. Library automation, including computers, microforms, and online processing and retrieval techniques, networking facilities, reprography, electronic security systems, word processing equipment and improved audiovisual equipment, are all technologies presently available as an aid to the performance of library chores and the provision of library services. By providing new forms of materials that validly belong in the library, technology serves to transform the libraries themselves. Each of these very different roles being played by technology is discussed in the subsections. Only currently available technology and its application to libraries is treated; technology expected to become available in the future and applications where technical feasibility has not yet been demonstrated are either excluded from the discussion or identified as such. (Author/RAA)

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NEW TECHNOLOGY FOR LIBRARIES

A Layman's Guide to Reducing Public Library Costs and Improving Services Through Scientific Methods and Tools

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INTRODUCTION

For many years librarians and trustees have grappled with conflicting demands to cut expenses and expand services. The day has finally arrived when new technology offers the possibility of doing exactly that. This background paper is intended to help the interested layman understand the potentials and the limitations involved in applying new technology to library operations. Its purpose is to help set the stage for changes in policy and planning.

Technology is a term more frequently associated with moon shots than with libraries. The word itself has a variety of meanings. One popular dictionary defines technology:

> 1. technical language. 2a. applied science. 2b. a technical method of achieving a practical purpose. 3. the totality of the means employed to provide objects necessary for human sustenance and comfort.

It is meaning 2b that comes closest to the usage of the word *technology* in this paper, although the other meanings provide useful additional perspective. The "practical purposes" to be achieved are the reduction of library costs and the improvement of library services. *Library costs* include, among other things, both the cost of acquiring library materials and the cost of making them available to the library's clientele. These costs can be measured both in terms of dollars and in terms of personnel. *Library services* include both traditional services and innovative services.

New technology can be employed as an aid to the performance of library chores and the provision of library services. By providing new forms of materials that validly belong in the collections of a library, technology serves also to transform the libraries themselves. Each of these very different roles being played by technology is discussed below. Only currently available technology and its application to libraries is treated here; technology expected to become available in the future and applications whose technical feasibility has not yet been demonstrated are either excluded from the discussion or identified as such.

LIBRARY CHORES AND LIBRARY SERVICES

Library work is highly labor intensive: A great deal of human effort goes into making the library run. Unlike, say, a telephone company, which employs a minimum staff of operators, installers, and office workers and spends a great deal on acquiring and operating telephone equipment, the typical library—especially in recent years—spends a continuously increasing proportion of its budget on personnel (reference staff, catalogers, security guards, etc.) and a decreasing proportion of the budget on books and other materials for the collections.

In the case of the telephone company, new and increasingly efficient equipment is continuously being introduced. Automatic switching equipment is a good example: No longer need every phone call be placed by an operator ("Mabel, get me Dr. Green—and hurry, please. This is an emergency!"). Instead we are asked to dial the number of the person we are calling; the automatic switching equipment connects us with that person's phone at a small fraction of the cost of paying an operator to do it. And faster, too. If we still relied on operators to place all of our calls, telephone service would be much more expensive than it is today. Calls that do require operator assistance are now handled by personnel using equipment speedier and more powerful than Mabel ever dreamed of.

But what about our library? Are we still doing the equivalent of placing phone calls by hand? New technol-

ogy offers assistance to the librarian in the performance of many of the chores necessary to running the place, such as book ordering, cataloging, and circulation, to name just a few. Each of these chores is discussed in its own subsection below. These technology-based assists help increase the productivity of each member of the library staff, thus helping to control library costs as inflation drives salaries increasingly higher.

The work done in libraries, in addition to being labor-intensive, tends also to be heavily duplicated from library to library. This may be especially true for public libraries: Almost every public library is likely to acquire—and therefore to catalog—the same current best sellers. Were each library to independently catalog each of these books, the effort wasted in repetitious—i.e., redundant—work would be enormous. Once one library has cataloged a particular book, other libraries should be able to use that catalog information in the majority of cases, instead of performing the chore of original cataloging all over again, many hundreds of times throughout the country. New technology is providing important assistance in expediting the sharing of catalog information, i.e., in controlling the cost of cataloging (see the section on catalogs and cataloging below).

Library materials themselves (books, magazines, etc.) are already very expensive and becoming even more so. Each library must of course acquire materials to meet the primary needs of its own clientele; this may entail duplicating a "core collection" of commonly used materials in many or even all libraries. But for libraries to duplicate holdings of less commonly used materials would be a profligate dissipation of increasingly scarce funds. Such

materials should be shared among libraries, i.e., a single purchase must be stretched as far as possible, by serving as many libraries—and their patrons—as possible (see the section on interlibrary loan below).

These and other problems facing public libraries today are the targets upon which the introduction of new technology into libraries has been focused. Separate subsections below describe the application of technology to the following library functions:

1. Acquisitions
2. Catalogs and Cataloging
3. Serials Control
4. Circulation Control
5. Information-Retrieval Services
6. Interlibrary Loan
7. Security
8. Management and Administration

Although the presentation is organized into discrete "application areas," the perceptive reader will observe that the boundaries between these areas are not always clean-cut.

Acquisitions

One library chore that can be assisted by new technology is the job of ordering books and keeping track of balances in the accounts from which payment is to be made. This is

the acquisitions function. A library needs to maintain close records regarding material currently on order, so as to avoid unintended duplication of orders and to be able to issue claim notices for material not received in timely fashion.

Maintaining large files of up-to-date information is one of the functions that modern electronic data processing (EDP) equipment—computers—can perform very effectively. Files of acquisitions data are in fact currently being maintained by computer for more than a few libraries. With a well-designed computer-based acquisitions system, current information about the status of an order can be speedily input into the computer's file (e.g., reports along the line of "Vendor reports item out of stock; will restock and supply," or "Item has been received in the library"). The updated information in the file can be disseminated to locations in the library where a need to know exists, such as the reference desk (in order to answer patron inquiries), the acquisitions department (where personnel may have to check on the status of any order at any time), and the cataloging department (where personnel may need a list of material that has currently been forwarded to them for cataloging). Because the computer is being used to maintain a machine processable file of current order information, the need to maintain manual files of similar information is eliminated. The computer can be made to monitor the file of outstanding orders and to print a claim notice for orders whose delivery is overdue. The computer-based system can be extended to monitor the flow of books through the full range of functions that librarians group under the heading of *technical services*—cataloging and

binding, in addition to acquisitions–i.e., to keep track of each book from the time it is ordered to the time it reaches the shelf and becomes accessible through the catalog. This can be an invaluable service: The larger the library, the more the job of tracking down a book "in the pipeline" becomes like searching for a needle in a haystack.

Catalogs and Cataloging

Cataloging is a library function (another chore in the area of technical services) that can benefit substantially from computer assistance. Computers, together with data communications technology, can be used not only to expedite the actual intellectual process of cataloging an item to be added to the collections of a library, but also to assist in the production of the physical products of the cataloging process. These products may be either of a familiar form (catalog cards) or of a new and unfamiliar form.

Catalog Products

Almost everyone has encountered the familiar library card catalog. It is stored in one or more filing cabinets containing drawers designed to hold standard size 3-by-5-inch (actually 7.5-by-12.5-cm) catalog cards, which are filed into the catalog in alphabetical sequence by author, by title, by

subject, etc.* But this is not the only form that a library catalog can take. The catalog of a library can be produced in book form, with many entries appearing on each page. The catalog of a library can be produced on microfilm or microfiche. The catalog of a library can reside in a computer, with access to the catalog provided through communications terminals.

CATALOG CARDS

Computers can be used to assist in the production of catalog cards. Imagine having to type by hand the four catalog cards for the book used in the example above (see footnote). The cataloger-typist would have to type out four nearly identical cards (the reason that they are not fully identical is that each card must indicate the entry point under which it is to be filed—in this example "Fisher . . ." for the author card, "Design . . ." for the title card, etc.—a lot of redundant typing, and not much fun, either). A computer can be instructed, through appropriate programming, to read in the catalog data for a book, to rearrange the data as many ways as required, and to print out the various arrangements of the data on special card stock.

* Each of these cards serves as the vehicle for an *entry* in the catalog. For instance, the book *The design of experiments* by Ronald A. Fisher (6th edition, published in Edinburgh by Oliver and Boyd, in 1951) might have the following entries made for it in the catalog: (1) an entry under the name of the author, (2) an entry under the title, (3) and (4) an entry under each of the subjects, "statistics" and "experimental design." Filed in the catalog under each of these entries would be a card containing a full description of the book: The card carrying the first entry would be filed in the F's under "Fisher, Ronald A."; the card carrying the second entry would be filed in the D's under "Design of experiments"; etc. The entry itself is the text that appears on the card; the card serves as a convenient vehicle for inserting the entry into the catalog.

In this example the computer would read in a single input record (the catalog data for the Fisher book) and produce four outputs (the four catalog cards). And, just to make things even nicer, the computer can be programmed to print out in one large "batch" all of the cards resulting from, say, a full day's cataloging, with the cards sorted into alphabetical sequence, to facilitate the work of the person whose job it is to file new cards into the catalog.

The use of electronic data processing (EDP) to assist in the production of catalog cards not only helps to cut costs (less typing, no need to manually alphabetize the cards prior to filing, elimination of variations introduced while retyping) but also speeds up the cataloging and catalog maintenance process, so that the catalog itself can be more up-to-date. On the other side of the balance, it should be noted that the rule of "garbage in, garbage out" (GIGO) applies here: An error occurring in the catalog data input into the computer will be faithfully reproduced on all of the cards. But even this cloud has a silver lining, since the computer can produce a full set of good cards as the result of a single correction being applied to the input data.

OTHER FORMS OF STATIC CATALOG

In the section on catalog cards the idea was presented of using a computer to take catalog data as input (one record for each book); to "explode" each record into multiple entries, the exact number being determined by the data themselves (depending, for example, on the number of authors who contributed to the book, and on the number of subject headings that the cataloger assigned to the book); and to print the entries on cards in an alphabetic sequence. This

same basic repertoire of functions can be enlarged upon to get the computer to print out the entries not one per card but several per page. These pages can be bound together into a book which now serves as the library's catalog. Various printing techniques can be employed to produce multiple copies of this book—i.e., of the catalog. Such a bookform catalog has a number of advantages: It is portable, and copies can be placed at various locations throughout the library (or library system) to bring the catalog to the people instead of requiring the people to bring themselves to the catalog.

A variation on the catalog in book form can be produced using special equipment that allows a computer to "print" its output directly onto microfilm, instead of onto paper (the generic name for the technology employed here is COM, for *c*omputer *o*utput *m*icrofilm). Of course, special equipment—a microfilm reader—is required in order for a human to read the catalog on microfilm, but this inconvenience in most cases is outweighed by the advantages of microfilm: even better portability than the bookform catalog, lower cost per copy than the printed and bound bookform catalog, ease of reproduction on demand. COM technology actually supports a pair of closely related media (or microformats), micro*film* and micro*fiche*. Microfilm is produced in strips either 16 or 35 mm wide and of arbitrary length, which are normally stored on reels (like movie film) accommodating up to 100 feet of film. Microfiche is produced on the same kind of film material, but wider and in shorter lengths (typically about 4 by 6 inches), which can be stored in envelopes or in file drawers.

Library catalogs in book form and in microform are

known generically as *pageform catalogs* because in both of them the user is able to look at many entries at once (i.e., to view a real page in the bookform catalog, or the image of a page in the microform catalog)—in sharp contrast with what the user sees in a card catalog: one single entry at a time, owing to the constraint of being able to look at only one card at a time.

Pageform catalogs are like telephone directories in one important respect: It is necessary to reprint everybody's phone number, including the ones that have not changed, in order to produce a new directory that includes the new and the changed numbers. The old phone book is then discarded and replaced in its entirety by the new one. Happily, a nice little trick can be used to avoid having to reissue the library's pageform catalog in its entirety just so that the newly cataloged books can be shown: A catalog supplement can be issued instead. Indeed, a *series* of supplements can be issued between reprintings of the full catalog. If the supplements are cumulative, then a comprehensive search of the catalog can be performed in only two lookups: one in the latest full reprint and one in the latest cumulative supplement.

In order to produce a pageform catalog by computer, the library must have a computer processable file of catalog data for all of the library material that is to be represented in the catalog. This does not necessarily mean that a library intending to start a computer-produced pageform catalog has to convert the entirety of its old catalog to machine-readable form. A library might decide to keep the old card catalog around, even though new cards were not being filed into it, and to put all of its new cataloging into the computer-produced catalog. This results in a "split cata-

log," with the older portion in card form and the newer portion in page form. On the other hand, some libraries have decided to convert their old card catalog into machine-readable form so that the new pageform catalog might be fully comprehensive and so that the old catalog on cards might be discarded.

AN INTERACTIVE CATALOG

All of the catalog products described above, under "Catalog Cards" and "Other Forms of Static Catalog," share an important characteristic. Once the product comes off the computer, it is immutable, i.e., static. The Fisher book, for example, can be found at only four places in the catalog, regardless of whether the catalog is in card form or in page form, and regardless of what other information about the book may appear in the entry.

A rather different design for a library catalog does away with the various products described above, although it does rely still on the existence of a file of catalog data stored in a computer. This design provides the user with a communications terminal (or console, if you prefer that word) through which the user issues commands to search the catalog and through which the results of the search are communicated back. Because the user interacts through the terminal with computer programs that search the file of catalog data for him, this variety of catalog is called an *interactive catalog*. An interactive catalog, if well designed, can offer the user much richer and easier access to the collections of the library than any of the static designs described above. The potential exists, for example, to allow the user to find a book under any word of the title, not just

the first word of the title. The potential exists also to allow the user to refine his request during the course of the search, depending on the results obtained thus far. The potential exists, too, for the user to express his search request in terms of data elements that are not normally used to organize a traditional catalog, e.g., date of publication, language of publication.

A few interactive catalogs are now in limited use in certain libraries, but they tend to be limited in some important aspects, for example, not available during all of the hours that the library is open, or limited to only materials cataloged after a particular date, or limited to only author and title access but not subject access. As the price of EDP and communications hardware continues to decline, as its reliability and capabilities continue to improve, as information scientists learn more about the design of effective man-machine dialogs, and as inflation continues to push the price of almost everything else upward, the prospects for interactive catalogs continue to brighten, but the day in which such a catalog serves as the only collection access tool for the entire library is still well in the future.

Cataloging

The preceding discussion of library catalogs focuses on the physical format of the catalog and on the method of its production. It was arbitrarily assumed that the job of cataloging somehow got done, with the result that catalog data became available for use. Although this assumption was useful for the purposes of the present pamphlet, it does tend to divert attention from a very important fact of life: The process of cataloging a book (or magazine, or phono-

graph record) for a library is a very expensive one. Consider that before a cataloger can complete the work of cataloging a book, the following sorts of considerations must be resolved: (1) What is the form of the author's name that we have established for use in our catalog? (2) What subject is this book about? (3) Is this a subject that we have other books on? (4) What subject terms did we use to describe those books in the catalog, so that we can use them to describe these as well? (5) Or is this book on a new subject, for which a new subject heading needs to be devised for the catalog? (6) Where on the shelves of the collection will this book fit best? Thus cataloging is an expensive chore when it has to be done "from scratch"—i.e., as *original cataloging*. The cost of cataloging can be reduced significantly (by as much as 50 or 75 per cent) when it is possible to rely on cataloging that has already been done elsewhere, rather than doing it all oneself.

Five major considerations bear on the utility to any library of cataloging done elsewhere. (1) It must adhere to generally accepted protocols and standards. (2) It must be of adequate quality (e.g., no spelling errors, sensible assignment of subject terms, etc.). (3) It must be compatible with local cataloging (the same terms used for the same subjects, etc.). (4) It must be available in timely fashion (we need the catalog data now, when we're ready to catalog the book, not two years later). (5) It must be easily accessible at reasonable cost (we're not going to spend $20 worth of time looking for a catalog record that will save us $10 worth of effort). Considerations (1), (2), and (3), although important, are beyond the scope of the present discussion. Considerations (4) and (5) are of interest,

because new technology has changed things so profoundly during the last ten years.

The idea of one library using another's cataloging is not new. The Library of Congress has been selling its catalog cards for precisely this purpose since the earliest years of this century. The printed *National Union Catalog* (NUC), issued by the Library of Congress, has enlarged on the same idea by distributing catalog information originating not only at the Library of Congress but at other libraries as well. (As its title suggests, the primary function of the NUC is that of a locating tool—to enable readers to learn which library in the nation holds some specific book. But a very important secondary function of the NUC is that of disseminating catalog data.) The establishment and growth during the last dozen years of *bibliographic utilities* has dramatically altered (1) the quantity of catalog data involved in this institutional interchange, (2) the balance of who's contributing it, (3) the speed with which it is disseminated, (4) the ease and cost with which it may be located and used.

A computer-based bibliographic utility is an organization that makes available to individual libraries catalog records via on-line (i.e., interactive) communications techniques. These utilities share in common the following characteristics: Each uses a computer to maintain a large file of catalog data in machine-readable form; each offers libraries interactive access to this file via a communications terminal located in the library and connected to the computer through an electronic communications link; each provides sophisticated search capabilities which allow a terminal operator at the user library to search the file of catalog data for a record for a specific book (magazine, phonodisc,

etc.); each provides the facility to print a set of catalog cards, tailored to the user library's needs, based on any catalog record found in the file; each provides the ability to accept the entry of a new catalog record into the file via the communications terminal, if the terminal operator fails to find in the file a catalog record for the book (or other item) being cataloged; records thus contributed to the file become available speedily to the other libraries using the system. Or, to restate in brief, the computer-based bibliographic utilities offer individual libraries interactive cataloging services based on large resource files.

Bibliographic utilities use EDP and electronic communications technologies to expedite the sharing of cataloging among the participating libraries, helping them to reduce costs first by reducing the proportion of original cataloging that each must do and second by offering an inexpensive catalog card production service. Pageform catalogs can also be produced by purchasing the actual machine-readable records from the utility and then processing them through a computer program of the sort described above under "Other Forms of Static Catalog." A number of vendors offer this sort of processing as a commercial service.

At present there are three major bibliographic utilities in the United States. OCLC, Inc. (formerly the Ohio College Library Center), with facilities located in Columbus, Ohio, is by far the largest and best known. The Research Libraries Information Network (RLIN), with facilities in Palo Alto, California, concentrates on serving the special requirements of research libraries and is operated by the Research Libraries Group, Inc. The Washington Library Network (WLN), with offices in the Washington State

Library at Olympia, presently concentrates on serving libraries in the Pacific Northwest. There are significant differences among the bibliographic utilities in areas such as the size of their file of catalog data, the range of processing functions supported, organizational governance, etc.

Serials Control

A serial is a publication issued in successive parts bearing numerical or chronological designations and intended to be continued indefinitely. Serials include periodicals, newspapers, annuals (reports, yearbooks, etc.), the journals, memoirs, proceedings, transactions, etc., of societies, and numbered monographic series. Serials control is one of the most difficult chores in the library. It combines the worst aspects of acquisitions and of cataloging.

The job of controlling a serial involves tasks such as checking in individual issues (or volumes) as they arrive, keeping alert for missing parts; renewing the subscription when appropriate; making sure that the serial continues to arrive; updating the catalog to reflect new holdings; collecting the issues that constitute a volume, when they have all arrived, and sending them to the bindery with appropriate binding instructions; and so on. To the extent that a serial is "well behaved"—i.e., that its behavior is regular—computer programs can be written that anticipate the next event that should take place and to facilitate it. For example, if one year has passed since the last payment has been

made, a subscription renewal payment voucher might be automatically produced; or if all the issues of a volume have been received, a binding instruction slip might be printed.

Serials control is complicated by the perverse tendency of serial publications to change. The publisher changes his name, or a weekly becomes bimonthly, or two journals merge, or a shipping strike holds up delivery of all European publications, or . . . The range of possibilities is virtually limitless. But, to the degree that the world is well behaved, computer assistance for the task of serials control is feasible. At least a few libraries have built their own serials control system and continue to operate it successfully, and one of the bibliographic utilities, OCLC, Inc., offers the service of a serials control system. The smaller a library is, the more likely it is that its serials are well behaved and that a mechanized serials control system will perform adequately. Computerized serials control is an area in which much development work remains to be done, but the successful performance of already existing systems—though not perfect—is encouraging.

Circulation Control

Circulation is the term used in librarian's jargon to refer to the chore of lending books out and checking them back into the library. Historically circulation control was one of

the first library chores to receive mechanized assistance. Various aids to the making and processing of circulation records have been employed over the years, utilizing the technologies of photography, tabulating card processing, and needle sorting of edge-punched cards, to name just a few. At present, the greatest promise for effectively assisting with the chore of circulation control lies with computers and the related technologies for data communications and data collection. Typically, a library will acquire a complete circulation control system from one of the half-dozen or so companies presently marketing them. The circulation control system consists of a small computer to which a number of communications terminals and data collection stations are connected via electronic communications links. A machine-readable label (like the bar-code labels that have appeared in the last few years on groceries) is affixed to each book that may circulate, and a file is established on the computer that reflects which label is affixed to which book. Library patrons are issued identification cards bearing machine-readable labels, and a file is established on the computer that reflects which card is held by which patron. When a patron wishes to borrow a book, he presents the book together with his ID card at the circulation desk, where the circulation clerk uses the data-collection equipment to read the patron's ID card and the book label and instructs the computer to update the files to show that this book has been checked out to this patron. While the computer is updating the files, it can check that the patron is in good standing. If the patron is not in good standing, the computer can be programmed to reject the charge transaction and to print out an explanatory mes-

sage as to the reason—e.g., "Patron already has maximum number of books out on loan," or "Patron owes excessive book fines." When the patron returns the book to the library, after having borrowed it, the circulation clerk uses the data-collection equipment to read the book label and instructs the computer to check the book back in. If the book is overdue, the computer immediately calculates the amount of the fine and advises the clerk to collect it from the patron. The computer checks its "hold" file to determine if another patron is waiting for this book. If so, a special message is sent to the circulation clerk to set the book aside; otherwise the clerk will return the book to the stacks (to its normal position on the shelves).

Circulation control systems roughly similar to the description above are installed in at least two hundred libraries in the United States. Such a system eliminates the need to maintain many manual files, speeds up processing at the circulation desk, and may additionally perform a variety of functions that the library did not or could not perform manually.

Information-Retrieval Services

A well-established division of responsibility has evolved over the years regarding the matter of providing intellectual access to the materials in the library. Access to the books is provided through the library's catalog, which is

maintained by the staff of the library. Access to the articles in the magazines and journals is provided through specialized indexes, which are produced by abstracting and indexing services, which are run sometimes commercially (e.g., the *Reader's Guide to Periodical Literature* of the H. W. Wilson Co.), sometimes by professional societies (e.g., *Chemical Abstracts*, produced by the American Chemical Society), and sometimes by public agencies (e.g., *Index Medicus*, produced at the National Library of Medicine). In the case of any of these "store-bought" indexes, the library is likely not to subscribe to every journal or magazine indexed, but to at least enough of them to justify the library's purchase of the index. In the event that a library patron consulting one of these indexes comes across an interesting citation of an article appearing in a journal not held in the library, it should be accessible nonetheless via interlibrary loan.

The advent of computer technology has made it practical to store an index of the sort just described (i.e., an organized file of citations) in the memory of a computer, to search the file for articles satisfying the search criterion, and to print out a list of those articles. This service is designated *information retrieval* to emphasize the fact that access is being offered to some particular corpus of literature, in contrast with the access provided by a catalog to the collections of a particular library.

An information-retrieval search can be run either in batch mode (the course of the search cannot be modified once the search process has been initiated, and the search result is like a miniature static catalog) or in interactive mode, through a communications terminal (the search

process is like that described above for an interactive catalog), depending on the design and facilities of the system. Batch searches are usually done in groups at a time when the computer is not otherwise in use, while interactive searches provide instantaneous response. An information-retrieval service may be locally developed and operated within an individual library or institution, or it may be offered commercially by a provider of information-retrieval services to the community at large.

Two important characteristics distinguish computer-based information-retrieval systems from their printed index counterparts: (1) The information-retrieval service can usually be used more flexibly than the printed index, in a way analogous to the advantages of an interactive catalog over a static one; and (2) the cost of purchased information-retrieval services continues to accrue as increased use is made of them—computer processing costs money—while the cost of a purchased, printed index remains fixed, regardless of how much use is made of it. Not only is the cost of information retrieval variable depending on use, it can mount up to substantial sums (not that some of the printed indexes aren't expensive, too). A printed index, once purchased, serves the entire clientele of the library, while an information-retrieval service requires additional library staff and each query serves only the individual for whom the search was run. This difference has become the crux of a dilemma for librarians: whether to offer personalized information-retrieval services in addition to providing access to the corresponding indexes, and whether or not a charge (either full or partial) should be imposed on the library patron for the cost of information-retrieval services consumed at his or her request.

Interlibrary Loan

Interlibrary loan (ILL), one particular variety of library resource sharing, is not necessarily a high technology-based service. The borrowing library sends a request letter on behalf of a patron to the lending library, which responds by mailing the requested book to the borrowing library. The borrowing library lends the book in turn to the patron. Eventually the book is returned by the patron via the borrowing library to the lending library. This mainstream scenario describes the simplest case of ILL; other more complicated cases are possible.

ILL has recently received three important boosts from new technology. (1) The advent of bibliographic utilities (see "Cataloging" above) has made it both easier and faster to determine where a desired item may be held. (2) The advent of data transmission technology has made the sending of the ILL request very much faster—via teletype, or via a specially designed computer-based network such as OCLC's ILL communications subsystem, or even via a shared circulation control system. (3) The advent of inexpensive photocopying ("Xeroxing") and of microfilming has made it possible for the lending library to fill the request without having to relinquish possession of the item —especially important if it is rare or valuable or in delicate condition or in heavy demand.

(The matter of photocopying in libraries raises some very important and complicated questions regarding the matter of copyright. These questions are beyond the scope of the present pamphlet, but the reader should maintain an awareness of their existence.)

Most commonly the item being borrowed on ILL is sent via a traditional carrier: the U. S. Postal Service, or sometimes United Parcel Service. The use of telefacsimile transmission (at electronic speeds) has been tried, but most telefacsimile experiments have not justified the increased cost.

In years past, both the difficulty of locating a copy of the desired item and the slowness of the subsequent ILL process served as natural inhibitors on the general level of ILL traffic. Currently, with book budgets increasingly strained and with technology-based aids making the mechanics of ILL both easier and faster, each library will be moved to rely more and more on ILL in lieu of purchase as a way of satisfying patron requirements. But the other side of this coin is that if more ILL requests are made, then more ILL requests will be received. While it must be true for the aggregated community of libraries participating in ILL activities that the number of ILL requests made is equal to the number received, it does not necessarily follow for any single library that the number of ILL requests it makes will be equal to the number it receives. Some libraries are net lenders and some are net borrowers. Library administrators will have to grapple with such matters as (1) ILL fees imposed by lending libraries and (2) appropriate criteria for the decision to buy versus borrow, as we strive toward the goal of a new technology-mediated equilibrium for ILL in the next few years.

Security

Collection Security

Unauthorized removal of library materials from the premises is a persistent problem. It has frequently been addressed by stationing a monitor at the library exit and charging him or her with the responsibility for checking packages, briefcases, and handbags. Although the presence of a monitor will discourage some persons from attempting to steal library materials, and the monitor will discover others in the act of unauthorized removal (either intentional or not), this approach to the problem of security is less than fully effective.

New technology offers help with the security problem through a variety of electronic pilferage detection systems, also called library security systems. All of the systems share the same general description. An electronic detection device is installed at each of the exits from the library. The books in the library's collection have a special detectable "target" inserted into each. If an attempt is made to remove a book bearing a target from the library, the detector sounds an alarm and, optionally, locks the exit turnstile, while the monitor at the exit investigates the problem. Special ancillary procedures are established for allowing persons with properly checked-out books to remove them from the building.

Pilferage detection systems of this general sort are available in a variety of designs from a variety of manufacturers. Although useful, they are not a cure-all; not every door and window through which a book might exit can be covered. But the electronic system does provide a real assist to the human monitor by detecting materials hidden in jacket linings and the like. The system does not, however, eliminate the need for a monitor; someone must be there to respond immediately when the alarm goes off. A significant expense may be entailed in inserting a "target" in each book. Some users recommend selective targeting of books, rather than comprehensive, on the ground that the deterrent effect is just as strong. Another approach to selective marking is to concentrate on the most heavily used portions of the collection (e.g., reference books) or on the most valuable (e.g., art books).

Some libraries using electronic pilferage detection systems have been able to gather quantitative data on book losses both before and after the installation of the system, and have been able to demonstrate substantial reductions in their rate of loss.

Building Security

Another kind of aid to library security is the recently introduced family of intrusion detection systems. These systems are like conventional burglar alarms intended to alert security staff (or police) to the presence of unauthorized persons in the area. The difference lies in the fact that a conventional burglar alarm is designed to detect the opening of a protected door or window, while these new systems are able variously to detect any sound or motion in-

side a monitored (i.e., protected) area. Some systems can be tailored to combine the functions of intrusion detection and fire or smoke detection.

Management and Administration

General Institutional Functions

Libraries share many functional activities in common with other kinds of institutions. These functions typically include payroll, accounts payable (paying the bills for pencils and dust mops, as well as for books), accounts receivable (collecting moneys for overdue fines, photoduplication charges, library publications, etc.), and, not infrequently, a healthy amount of typing (of reports, library guides, and bibliographies, in addition to everyday correspondence). Libraries can obtain assistance with these activities using EDP and other technologies, just the same as any other enterprise. The same kind of implementation considerations apply to libraries as to other organizations: For example, are we big enough to justify installing our own equipment, or should we rely on externally provided services? Of the four categories of functions mentioned above, the first three—payroll, accounts payable, and accounts receivable—are standard commercial EDP functions; the fourth—typing—is a more recently developed computer application commonly referred to as *word processing*.

Special Library Functions

Once computer-based assistance for basic library functions has been provided (acquisitions, circulation control, etc.), a foundation will have been provided for supplying information about the library's operation that will assist in the making of informed managerial, administrative, and policy decisions in the library. Examples of such information that can be extracted as a by-product of specific computer applications are:

1. From the acquisitions system—comparative analysis of vendor performance; the annual effect of inflation on book prices; a breakdown of current acquisitions by country, by language, etc.; work flow data on the growth or contraction of processing backlogs; productivity data on various departments.

2. From the cataloging system—a breakdown by subject area of materials currently being added to the collections.

3. From the circulation system—an analysis of collection use by subject class, by collection or branch, by time of day, by day of week.

This kind of information was in no sense inherently unknowable previously, but the cost in human efforts of collecting or extracting it, and of organizing it for analysis was in many cases prohibitive. Now with a comparatively modest investment in additional computer programming, it can be gleaned as a by-product from systems that are already performing the information processing chores of acquisitions, cataloging, circulation control, and so on.

THE TRANSFORMED LIBRARY

The classical image of a library is that of a collection of books—both hardbound monographs and serials bound into volumes. This image is no longer wholly accurate. Libraries are collecting a continuously broadening variety of materials bearing little resemblance to the archetypal codex or bound volume.

Technology itself is spawning new forms of material—e.g., films, sound recordings, microfilms—which validly belong in the collections of libraries as intellectual or recreational resources. Technology is also involved in redefining the boundaries of the library: Outreach and special service programs, although not new in themselves, are assuming new forms as new technologically based vehicles are explored. It is also facilitating the development of networks for interlibrary loan purposes, so that each member's collection is suddenly expanded significantly through easy access to the shelves of other network member libraries in the state or region.

One of the most revolutionary changes in library function made possible by the new technology is providing up-to-the-minute information on social benefit services to individual citizens. I&R has been growing rapidly as a basic service in public libraries, but with a simultaneous computer link to government offices at city hall, the state capitol, and Washington, D.C., all at the same time, the ability to provide essential information on health, welfare, social

security, education, and scores of other programs on demand is almost breathtaking.

Microforms

Microfilm and microfiche are the two most common varieties of microform; they are described above in the section on catalogs and cataloging. Increasingly libraries are acquiring microforms as an alternative to books and journals. Microforms have several important advantages. First, they can be easily reproduced, if the reader requires a copy. Second, they are very compact, in comparison with full-size materials. (Storage compaction is an important weapon in the war against the "space crunch" being waged in many libraries.) Third, with compactness also comes portability; whole sets of books, whole runs of journals can be borrowed at one time—even the library's catalog, if it exists in microform (note that the library patron may need to borrow the reader equipment, as well as the microform).

A variety of goals can be served by microforms in the library, all related to the basic functions of preservation and dissemination: to reduce wear and tear on rare materials; to provide access to material not locally available in their original form, e.g., out-of-print materials; to preserve an image of deteriorating materials, especially newspapers; to provide a permanent copy of material too expensive or difficult to bind in the original form received in the library; to provide broad access to special collections, including "synthesized" collections, which exist together only on the

film, the originals being held in various libraries at different geographical locations.

Films and Other Projectable Materials

Included in this group are motion pictures, photographic transparencies (slides), film strips, and composite audiovisual presentations (e.g., synchronized slides and sound recordings).

Sound Recordings

Sound recordings are available in a proliferating variety of formats, including not only disks (in various sizes and speeds) but also magnetic tapes (on open reels, in cassettes, and in cartridges).

Video Recordings and CATV

With the introduction of video (television) recording and playback equipment constantly reducing prices for the in-

dividual consumer, it is not surprising that a new industry is coming into existence in the area of prerecorded videotapes. As this medium of communication earns broader acceptance, it is inevitable that libraries will start to build collections of material in this medium.

A related technology, also newly developing, is sure to have a related impact on libraries. CATV, cable television (or controlled access television, as some call it), serves as the vehicle for locally originating library outreach programs, aimed at school classes, at persons who are not habitual users of the library, and at disadvantaged segments of the population. CATV can serve also as the medium for special services to the homebound, e.g., the sick and the handicapped. These programs are likely to be prerecorded, and the library will naturally have a strong interest in preserving the recording in its collection of videotapes, either for rebroadcast or for patron use within the library. One of the most ambitious cable television operations sponsored by a public library has been run by the Tri-County Regional Library out of Rome, Georgia, under the guidance of the library's director, Emily C. Payne. The library produces over forty hours of programs per week, and has generated a marked increase in the use of conventional library materials as a result of its cable TV outreach.

Machine-Readable Data Files

A machine-readable data file (MRDF) is a file of data that can be processed by computer. It is not at all uncommon

for a large research library to hold a substantial collection of MRDF's, containing such material as census data, public opinion polls, congressional voting records, and economic indicators. MRDF's are most commonly stored on reels of magnetic tape. With the advent of "personal computing," a hobby that has begun to catch on seriously in the last couple of years, it is not unreasonable to anticipate that MRDF's will move from the rarefied precincts of the research library into the more accessible domain of the public library.

QUESTIONS AND ANSWERS

The reader may have inferred from the preceding sections that a knight in shining armor bearing the heraldic device of High Technology has just galloped up to the gates of the library, and that all we need do is welcome him with open arms, in order to alleviate our problems. This is not the case. There still remain unanswered questions and unresolved problems, of which a few are presented here.

Who Pays . . . and for What?

In the section above on information-retrieval services the question of payment for individually consumable services was broached. A similar—but not identical—problem has always existed in the purchase of a book of such narrow interest that it is likely to be used only by the single individual who requested it. The difference lies in the fact that this book, once purchased, continues to reside in the collection and thus remains accessible to others who may indeed use it, while the result of the individualized information-retrieval search is not, in most cases useful to anyone except the person for whom the search was performed.

Similarly, the benefit of the time spent by a reference librarian with a library patron answering his question ac-

crues solely to the patron, yet we consider the charging of reference fees directly to the patron only rarely and for very extensive undertakings, such as the compilation of a special bibliography. Ultimately the question of fee for service evolves into a question of public policy, rather than one to be solved by technical or professional expertise.

The question "Who pays?" exists as well on another level besides that of the individual library patron. At the institutional level the problem exists of how to fund the capital investment necessary to introduce new technology. This brings the discussion ultimately to the question of funding for public libraries, an extremely important matter, beyond the scope of this particular paper.

Where Do We Go from Here?

Much has been written over the last few years about the emerging national electronic bibliographic network for libraries. This network might serve to link the national libraries (the Library of Congress, the National Agricultural Library, and the National Library of Medicine) and the bibliographic utilities into a comprehensive system, to which all of the libraries of the nation would have access. Although much has been written on this subject, an agreed plan for the implementation of this national network does not yet exist.

No one's crystal ball is totally unclouded, but it is fair to observe that the substantial investments already made in

the three major bibliographic utilities (OCLC, RLIN, and WLN) will probably ensure that they will be incorporated into any national network as components, rather than ignoring or—even more unlikely—disassembling them.

Groups of interested people in at least three offices in Washington, D.C., are concerned with facilitating the establishment of this anticipated national network—at the National Commission for Libraries and Information Science, at the Library of Congress, and at the Council for Library Resources, a privately funded nonprofit organization. Whether the White House Conference on Library and Information Services, moves the nation any closer to this goal—by mobilizing support for it, by reaffirming its importance, and by devising some effective means to implement it—is a matter that will have profound effect on the future of libraries throughout the United States.

SUMMARY

A wide range of technologies currently offers assistance for the library. These technologies include electronic data processing (computers), data collection, and data communications; micrographics; video transmission and recording; audio recording; and intrusion detection. These technologies are employed sometimes singly and sometimes in combination. These new (or not so new) technologies impact both the performance of library support chores and the definition of the library itself, as manifested in the collections and in the services that reach the patron directly.

Challenges exist at many levels. At the local level the individual library strives to provide its patrons with the best service it can, within the limits of its means; this entails, among many other things, deciding how best to exploit technology within the local context. At the national level, questions of policy, of coordination, and of support will be resolved either through action or through inaction. The White House Conference will serve as an arena where a unique opportunity is afforded to articulate concerns and to establish a consensus regarding library and information services for our nation. Although technology is not an end in itself, its service in the interest of libraries and of the people libraries serve must be carefully attended to, if technological support is to be ready when it is needed.

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FOR MORE INFORMATION

More information about new technology for libraries is available in abundance. The sources cited here will provide the interested reader with a good start.

West, Martha W., and Quiros, Alice. "Library Automation: A Bibliography, 1973–77." *Journal of Library Automation*, Vol. 11, No. 4, 339–65. Reprints of this bibliography are available from the Library and Information Technology Association (a division of the American Library Association), 50 East Huron Street, Chicago, Illinois 60611.

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